



Energy & Environmental Research Center

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October 30, 2020

Ms. Karlene Fine  
Executive Director  
North Dakota Industrial Commission  
State Capitol, 10th Floor  
600 East Boulevard Avenue  
Bismarck, ND 58505-0310


Dear Ms. Fine:

Subject: Quarterly Progress Report Entitled "Research in Support of Integrated Carbon Capture and Storage for North Dakota Ethanol Production"; Contract No. R-043-053; EERC Fund 25204

Attached is the subject report for the period of June 1, 2020, through September 30, 2020, that shows the progress that has been made with partners of this project.

Thank you for funding this work. If you have any questions, please contact me by phone at (701) 777-5013 or by e-mail at kleroux@undeerc.org.

Sincerely,

DocuSigned by:  
  
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Kerryanne M. Leroux  
Principal Engineer, Subsurface R&D

KML/kal

Attachment

c/att: Andrea Holl Pfennig, NDIC



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# **RESEARCH IN SUPPORT OF INTEGRATED CARBON CAPTURE AND STORAGE FOR NORTH DAKOTA ETHANOL PRODUCTION**

Quarterly Progress Report

*(for the period of June 1, 2020, through September 30, 2020)*

*Prepared for:*

Karlene Fine

North Dakota Industrial Commission  
State Capitol, 14th Floor  
600 East Boulevard Avenue, Department 405  
Bismarck, ND 58505-0840

Project Period: June 1, 2020 – November 30, 2021  
Contract No. R-043-053

*Prepared by:*

Kerryanne M. Leroux

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October 2020

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## **RESEARCH IN SUPPORT OF INTEGRATED CARBON CAPTURE AND STORAGE FOR NORTH DAKOTA ETHANOL PRODUCTION**

### **EXECUTIVE SUMMARY**

The Energy & Environmental Research Center (EERC) at the University of North Dakota (UND), in partnership with the North Dakota Industrial Commission (NDIC) and North Dakota ethanol producer Red Trail Energy (RTE), is conducting the fourth phase (Phase 4) of a multiphase research and development effort to create the first integrated carbon capture and storage (CCS) system in North Dakota for the reduction of carbon emissions from ethanol production and capitalize on evolving low-carbon fuel (LCF) markets. The ultimate goal of this effort is implementation of a small-scale (<200,000 metric tons, or tonnes, CO<sub>2</sub> per year) commercial CCS system at an industrial fuel production facility to generate a reduced-carbon ethanol fuel applicable for LCF programs. Actions this quarter toward supporting continuation of the CCS effort at the RTE site include the following:

- Completed Milestone 1 (M1) – Core Received by UND EERC
- Completed preliminary geologic characterization and evaluation, which continues to support that the Broom Creek Formation provides adequate injectivity, capacity, and containment at the RTE CCS site, and that sufficient data and information have been collected to complete the North Dakota CO<sub>2</sub> Storage Facility Permit (SFP) application.
- Completed the static geologic model for the RTE CCS site, incorporating logging data and updated seismic interpretation, and began incorporating core analysis data (e.g., porosity, permeability, etc.) for generating CO<sub>2</sub> simulation forecasts.
- Completed revised material packets for Stark and Richardton Commissions to provide an RTE CCS Project update via e-mail (August 24), particularly with regard to RTE's second well drilling (RTE-10.2).
- Next quarter, the laboratory analyses, modeling, and simulations will be completed. Development of the regulatory incentives crosswalk will also begin to determine additional needs beyond the North Dakota SFP application for California LCF Standard program and Section 45Q incentive requirements. Outreach activity plans will be finalized and preparations begun for execution, to line up with concluding technical information gathering for a SFP application.

The EERC holds an unwavering commitment to the health and well-being of its employees, partners and clients, and the global community. As such, precautionary measures have been implemented in response to COVID-19. Staff continue to carry out project-related activities remotely, and personnel supporting essential on-site laboratory and testing activities are proceeding under firm safety guidelines. Travel has been minimized, and protective measures are being undertaken for those who are required to travel. At this time, work conducted by EERC employees is anticipated to progress with minimal disruption. Challenges posed by economic

variability will be met with open discussion between the EERC and project partners to identify solutions. The EERC is monitoring developments across the nation and abroad to minimize risks, achieve project goals, and ensure the success of our partners and clients. In the event that any potential impacts to reporting, scope of work, schedule or cost are identified, they will be discussed and addressed in cooperation with the project partners.

## **RESEARCH IN SUPPORT OF INTEGRATED CARBON CAPTURE AND STORAGE FOR NORTH DAKOTA ETHANOL PRODUCTION**

### **ACCOMPLISHMENTS**

#### **Major Goals of the Project**

The ultimate goal of this effort is implementation of a small-scale (<200,000 tonnes CO<sub>2</sub> per year) commercial carbon capture and storage (CCS) system at an industrial fuel production facility to generate a reduced-carbon ethanol fuel applicable for low-carbon fuel (LCF) programs. To achieve that goal, the Energy & Environmental Research Center (EERC), in partnership with the North Dakota Industrial Commission (NDIC) and Red Trail Energy (RTE), is conducting the fourth phase (Phase 4) of a multiphase research and development effort to create the first integrated CCS system in North Dakota for the reduction of carbon emissions from ethanol production and capitalize on evolving LCF markets.

#### **Accomplishments under These Goals (for the reporting period)**

In summary, Phase 4 will collect the data necessary to advance the RTE case study for ultimate implementation of the first integrated ethanol and CCS facility in North Dakota. This research and complementary RTE activities will advance the CCS effort toward a financial investment decision on commercial implementation. The expected results of this supporting research will therefore ensure secure injection and storage economic viability, regulatory compliance, public knowledge sharing, and generation of a North Dakota Class VI blueprint to effectively assist implementation of CCS by other North Dakota renewable energy or biofuel producers.

Specific research objectives for this subtask are to generate 1) a summary of site-specific geologic evaluation steps necessary to finalize CCS designs that ensure safe injection and storage; 2) contrasts—comparisons of federal and other state-level incentive requirements with the North Dakota Class VI Program, to establish potential business cases and ensure economic viability; 3) detailed interpretations and documentation needs to ensure regulatory compliance for CO<sub>2</sub> injection and storage; 4) community engagement and information dissemination, assessing impact, to ensure public knowledge sharing; and 5) documentation of pertinent outcomes to generate a North Dakota Class VI blueprint, to effectively assist implementation of CCS by other North Dakota renewable energy or biofuel producers.

#### ***Task 1.0 – Geologic Characterization and Evaluation***

This task comprises the remaining research activities needed to conduct an in-depth investigation of the geology of the RTE site, necessary for the preparation of a compliant North Dakota carbon storage permit package (Task 4). Data and samples have been collected from a stratigraphic test well drilled at the RTE CCS site (RTE-10) in March 2020. This activity includes laboratory analyses of collected geologic core samples (e.g., petrophysical, geomechanical, etc.), laboratory analyses of collected reservoir fluid samples (e.g., chemistry,

salinity, etc.), and data processing of collected downhole geophysical logging and formation testing results (e.g., dipole sonic, pulsed-neutron logging, etc.). Results of these activities will also provide necessary inputs for Tasks 2–4. The process of data needs identification, subsequent collection, and logistics associated with these activities will be detailed in Deliverable 1 (D1). CO<sub>2</sub> Storage Characterization Methodologies Report as a guide to other biofuels producers.

Significant accomplishments for Task 1.0 during the reporting period include the following:

- Completed M1 – Core Received by UND EERC
  - The collected geologic core samples from the RTE-10 stratigraphic test well were received by the University of North Dakota (UND) EERC on June 9, 2020.
  - Collected RTE-10 core totaled > 930 ft from the Inyan Kara Formation and Broom Creek Formation, as well as overlying and underlying seals for both.
- Completed the laboratory analyses shown in Table 1 on RTE-10 core collected.

**Table 1. Laboratory Analyses Performed on Collected Geologic Core from the RTE-10 Stratigraphic Test Well**

<b>Analysis Conducted</b>	<b>Total Samples</b>
Porosity Measurements	93
Permeability Measurements	93
X-Ray Fluorescence (rock chemistry)	104
X-Ray Diffraction (rock mineralogy)	104
Mercury Injection Capillary Pressure (pore-size distribution and capillary pressure data)	20

- Completed preliminary evaluation, which continues to support that the Broom Creek Formation provides adequate injectivity, capacity, and containment at the RTE CCS site and that sufficient data/information have been collected to complete the North Dakota CO<sub>2</sub> Storage Facility Permit (SFP) application.

### ***Task 2.0 – Modeling and Simulation***

Task 1 results are being used to update geologic interpretations of the target CO<sub>2</sub> storage reservoir and seal(s) as well as refine injection designs and CO<sub>2</sub> plume predictions essential for permitting. Industry-standard software packages are being used in the updates of previous geologic models of the study area and development of new CO<sub>2</sub> injection simulation cases. If needed, revisions will also be made to capture and transport infrastructure designs to

accommodate finalized injection designs. The processes by which data are integrated into geologic models and used to develop predictions of plume behavior will also be described in D1.

Significant accomplishments for Task 2.0 during the reporting period include the following.

- Task 2 modeling/simulation teams coordinated with Task 1 laboratory/field teams to ensure all data input needs were being generated during core analyses and logging.
- Completed the static geologic model for the RTE CCS site, incorporating logging data and updated seismic interpretation, and provided it to the simulation team.
- Began incorporating core analysis data (e.g., porosity, permeability, etc.) for generating CO<sub>2</sub> simulation forecasts.
- Current capture and transportation infrastructure designs were validated for sufficiently supporting current injection designs and operational plans, i.e., no changes needed.

### ***Task 3.0 – Business Case Analysis***

LCF programs and other CCS incentives (e.g., Section 45Q) continue to be assessed to develop a business case analysis of North Dakota ethanol CCS commercial application. This task includes investigations of business cases implementing requirements from various LCF/incentive programs into North Dakota carbon storage permits to establish synergistic relationships between multiple oversight authorities at state and federal levels. This integration will allow North Dakota to provide verification for other oversight authorities through North Dakota's established permitting and oversight process. Analysis of these synergies will include a "crosswalk," or contrast-comparison, of the various programs and recommendations for leveraging symbiotic opportunities while also ensuring full compliance (D2. CCS Business Crosswalk).

Significant accomplishments for Task 3.0 during the reporting period include the following:

- Reviewed California LCF Standard (LCFS) program approval process for potential third-party reviewers; the LCFS CCS Permanence Certification process requires approved professional engineer and geologist reviewers.
- Identified several updates regarding CCS Protocol clarification and the general LCFS program:
  - LCFS approved the use of sidewall core for RTE-10.2, specific to RTE's case because of the close proximity of RTE-10 with full core sampled.
  - LCFS is currently operating remotely, at 90% capacity, i.e., more time may be needed for questions and scheduling meetings.

- LCFS will no longer be accepting ethanol-CCS Design-Based Pathway (DBP) applications, stating RTE's DBP is a sufficient example; they might consider a request if explicitly needed by investors.

#### ***Task 4.0 – Carbon Storage Permitting***

Final documentation is being prepared to satisfy a North Dakota CO<sub>2</sub> SFP as detailed in North Dakota Administrative Code Chapter 43-05-01. The North Dakota permit covers multiple design aspects developed to ensure safe and effective site assessments, carbon storage operations, and postinjection monitoring. The draft documents initiated to satisfy the CO<sub>2</sub> SFP application are being finalized with the proposed characterization results from Task 1 and reviewed with North Dakota Department of Mineral Resources such that RTE may submit for approval to start final CCS implementation (D3. CO<sub>2</sub> Storage Facility Permitting Guidance Document).

Significant accomplishments for Task 4.0 during the reporting period include the following:

- Developed approach and action plan for completing draft documents of the SFP application.
- Designated writing assignments and action items, specifically for creating the required Geologic Exhibits component.

#### ***Task 5.0 – CCS Community Outreach***

The EERC continues to support local RTE efforts for public acceptance of North Dakota CCS targeted to landowners, Richardton and adjacent communities, city/county commissions, and regional educators. Areas of focus include stakeholder engagement activities in support of research and fieldwork, production and dissemination of informational materials, community outreach, implementation of a system to track engagement activities and acquire feedback, and ongoing assessment of progress. Building on the outreach experience and materials from 2019 activities, the project team is developing additional outreach materials and media and updating the project Web pages hosted on the EERC's Plains CO<sub>2</sub> Reduction (PCOR) Partnership website. The experience and materials developed will be incorporated into D4. CCS Outreach Tool Kit.

Significant accomplishments for Task 5.0 during the reporting period include the following:

- Completed revised material packets for Stark and Richardton Commissions to provide an RTE CCS Project update via e-mail (August 24), particularly with regard to RTE's second well drilling (RTE-10.2).
- In the wake of the COVID pandemic, the EERC and RTE are investigating alternative avenues and approaches to the activities conducted previously, such as community open

houses and in-person update meetings; examples under investigation include informational videos, virtual Q&A forums, a series of media and materials releases, etc.

### ***Task 6.0 – Management and Reporting***

This task includes managing project activities and ensuring coordination and planning of the project with participants and sponsors.

Significant accomplishments for Task 6.0 management during the reporting period include the following:

- Finalized NDIC and RTE contracts, accounts setup, and internal kickoff meeting (July 10) for activities start.
- Updated project timeline to prioritize project activities with arrival of RTE-10 raw data and samples.

### **Plan for the Next Reporting Period to Accomplish the Goals**

All activities will continue progressing toward project goals. The laboratory analyses, modeling, and simulations will be completed and drafting of D1 report will begin. Development of the D2 crosswalk will also begin to determine additional needs beyond the North Dakota SFP application for California LCFS and Section 45Q incentive requirements. Outreach activity plans will be finalized and preparations begun for execution, to line up with concluding technical information gathering for a SFP application and development of the D3 document.

## **PRODUCTS**

### **Publications, Conference Papers, and Presentations**

None.

### **Web Site(s) or Other Internet Site(s), Technologies or Techniques, Inventions, Patent Applications, and/or Licenses**

None.

## **CHANGES/PROBLEMS**

As mentioned previously in the Task 5 discussion, in the wake of the COVID pandemic, the EERC and RTE are investigating alternative avenues and approaches to the in-person activities conducted previously. Examples under consideration include but are not limited to informational videos, virtual question and answer forums, and a series of media/materials releases.

The EERC is operational and open for business. Personnel that are not essential for on-site operations have transitioned to working from home. Essential project, laboratory, and field-based activities are proceeding with the incorporation of the Centers for Disease Control and Prevention (CDC), the state of North Dakota, and UND guidelines associated with COVID-19, and mitigation measures have been implemented.

In collaboration with project partners, the EERC is continually assessing potential impacts to project activities resulting from COVID-19 and/or the U.S. economic situation.